

IN THE CLAIMS:

1. (Currently Amended) A storage system ~~storing that stores~~ block groups including ~~plural storing a plurality of~~ object blocks in ~~plural a plurality of~~ storage devices ~~dispersedly~~, one of said ~~storing~~ object blocks being a redundancy block ~~which is comprising~~ redundancy data used if ~~any one of the plural other storing plurality of~~ object blocks is defective, ~~to rebuild this storing object block~~, the storage system comprising:

~~plural a plurality of~~ storage devices;

a block writer ~~storing each of the plural storing~~ that stores in different ones of the plurality of storage devices object blocks and a copied object block ~~copied from any of plural storing object blocks in different storage devices~~;

a block rebuilder ~~operating if responsive to a defect is being detected in any of said an~~ uncopied ~~storing one of said~~ object blocks, to rebuild ~~said a corresponding~~ defective ~~storing~~ object block based on ~~said plural storing stored ones of the~~ object blocks other than said defective ~~storing~~ object block; and

a rebuild block overwriter ~~overwriting the that overwrites a rebuilt storing~~ object block on one of the copied object block or on the storing and an original object block ~~which that is an original of the copied object block~~.

2. (Currently Amended) The storage system according to claim 1, wherein for each of said ~~plural~~ block groups, said block writer stores in said different storage devices each of said ~~plural storing plurality of~~ object blocks included in the block group and said copied block ~~in said different storage devices~~,

wherein if one of said storage devices is defective, then for each of said block groups in which an uncopied ~~storing~~ object block is stored in said defective storage device, said block rebuilder rebuilds said defective ~~storing~~ object block based on ~~said plural storing object blocks other than said storing object blocks other than the object block~~ stored in said defective storage device, and

wherein for each of said block groups in which an uncopied ~~storing~~ object block is stored in said defective storage device, said rebuild block overwriter overwrites said rebuilt ~~storing~~ object block on the one of said copied object block ~~or and~~ said storing original object block ~~which is an original of said copied block.~~

3. (Currently Amended) The storage system according to claim 1, wherein said block writer stores each of said ~~plural storing plurality of~~ object blocks and ~~said a~~ copied object block that is copied from said redundancy block ~~included in said plural storing object blocks~~, in said different storage devices.

4. (Currently Amended) The storage system according to claim 3, further comprising:

a request receiver ~~receiving to receive~~ a write request for a write of write data to a plurality of data blocks that are said ~~plural storing plurality of~~ object blocks other than said redundancy block; and

a redundancy block generator ~~generating to generate~~ a new redundancy block based on said plurality of data ~~block blocks~~ to which the write data is to be written, on said write data, and on ~~an~~ said original redundancy block, and

wherein said block writer writes said write data to said plurality of data ~~block blocks~~ to which the write data is to be written and writes said new redundancy block to said original redundancy block and to said copied block.

5. (Currently Amended) The storage system according to claim 1, wherein said block writer stores in said different storage devices each of said ~~plural storing plurality of~~ object blocks and said copied block that is copied from any one of plural data blocks ~~that are said plural storing corresponding to said plurality of~~ object blocks other than said redundancy block, ~~in said different storage devices.~~

6. (Currently Amended) The storage system according to claim 5, further comprising:

a request receiver ~~receiving~~ to receive a write request for a write of write data to a plurality of data blocks that are said ~~plural storing~~ plurality of object blocks other than said redundancy block; and

wherein if said data block to which the write data is to be written is said original object block, said block writer writes said write data to each of said original ~~block~~ object blocks and to said copied block, and if said data block to which the write data is to be written is not said original object block, said block writer writes said write data to said data block to which the write data is to be written.

7. (Currently Amended) A controller for a storage system storing block groups including plural ~~storing~~ object blocks in plural storage devices ~~dispersedly~~,

one of said ~~storing~~ object blocks being a redundancy block ~~which is~~ comprising redundancy data used if any one of the plural other ~~storing~~ object blocks is defective, ~~to rebuild this storing object block~~, the controller comprising:

a block writer ~~storing each of the plural storing~~ that stores in different ones of the plural storage devices object blocks and a copied object block ~~copied from any of plural storing object blocks in different storage devices~~;

a block rebuilder ~~operating if responsive to a defect is being~~ detected in ~~any of said an~~ uncopied ~~storing one of said~~ object blocks, to rebuild ~~said a corresponding~~ defective ~~storing~~ object block based on ~~said plural storing~~ stored ones of the object blocks other than said defective ~~storing~~ object block; and

a rebuild block overwriter ~~overwriting the~~ that overwrites a rebuilt ~~storing~~ object block on one of the copied object block ~~or on the storing and an original~~ object block ~~which that~~ is an original of the copied object block.

8. (Currently Amended) A method ~~for controlling~~ to control a storage system ~~storing to store in~~ plural storage devices block groups ~~including that comprise~~ plural ~~storing~~ object blocks in plural

~~storage devices dispersedly,~~

one of said ~~storing~~ object blocks being a redundancy block ~~which is comprising~~ redundancy data used if any one of the ~~plural other storing plurality of~~ object blocks is defective, ~~to rebuild this storing object block,~~ the method comprising ~~the steps of:~~

~~a block writing step of storing in different storage devices~~ each of the plural ~~storing~~ object blocks and a copied block that is copied from any of one of the plural ~~storing~~ object blocks ~~in different storage devices;~~

~~a block rebuilding step of operating if a defect is detected responsive to detecting a defect in any of said an~~ uncopied ~~storing~~ object blocks block, ~~to rebuild said rebuilding the~~ defective ~~storing~~ object block based on said ~~plural storing a plurality of~~ object blocks other than said defective ~~storing~~ object block; and

~~a rebuild block overwriting step of overwriting the rebuilt storing object block on the one of the copied block or on and the original object block of the copied storing object block which is an original of the copied block.~~

9. (Currently Amended) A computer program for controlling to control a storage system ~~storing that stores in a plurality of storage devices~~ block groups including comprising plural ~~storing~~ object blocks ~~in plural storage devices dispersedly,~~ one of said ~~storing~~ object blocks being a redundancy block ~~which is comprising~~ redundancy data used if any one of the ~~plural other storing plurality of~~ object blocks is defective, ~~to rebuild this storing object block,~~ the computer program allowing comprising computer executable program instructions comprised of said storage system ~~to function as:~~

first computer executable program instructions to implement a block writer ~~storing each of the plural storing that stores in different ones of the plurality of storage devices~~ object blocks and a copied object block copied from any of plural ~~storing~~ object blocks ~~in different storage devices;~~

second computer executable program instructions to implement a block rebuilder ~~operating if that~~

is responsive to a defect is being detected in any of said an uncopied storing one of said object blocks, to rebuild said a corresponding defective storing object block based on said plural storing stored ones of the object blocks other than said defective storing object block; and

third computer executable program instructions to implement a rebuild block overwriter overwriting the that overwrites a rebuilt storing object block on one of the copied object block or on the storing and an original object block which that is an original of the copied object block.

10. (Currently Amended) A storage medium in which the program according to claim 9 is stored computer program according to claim 9, embodied on a tangible computer readable media.

11. (New) The computer program according to claim 9, wherein for each of said block groups, said first computer executable program instructions stores in said different storage devices each of said plurality of object blocks included in the block group and said copied block,

wherein if one of said storage devices is defective, then for each of said block groups in which an uncopied object block is stored in said defective storage device, said second computer executable program instructions rebuilds said defective object block based on object blocks other than the object block stored in said defective storage device, and

wherein for each of said block groups in which an uncopied object block is stored in said defective storage device, said third computer executable program instructions overwrites said rebuilt object block on the one of said copied object block and said original object block.

12. (New) The computer program according to claim 9, wherein said first computer executable program instructions stores each of said plurality of object blocks and a copied object block that is copied from said redundancy block in said different storage devices.

13. (New) The computer program according to claim 12, further comprising:

fourth computer executable program instructions to implement a request receiver to receive a write request for a write of write data to a plurality of data blocks corresponding to a plurality of

object blocks other than said redundancy block; and

fifth computer executable program instructions to implement a redundancy block generator to generate a new redundancy block based on said plurality of data blocks to which the write data is to be written, on said write data, and based on an original redundancy block, and

wherein said first computer executable program instructions writes said write data to said plurality of data blocks to which the write data is to be written and writes said new redundancy block to said original redundancy block and to said copied block.

14. (New) The computer program according to claim 9, wherein said first computer executable program instructions stores in said different storage devices each of said plurality of object blocks and said copied block that is copied from any one of plural data blocks corresponding to said plurality of object blocks other than said redundancy block.

15. (New) The computer program according to claim 14, further comprising:

fourth computer executable program instructions to implement a request receiver to receive a write request for a write of write data to a plurality of data blocks corresponding to a plurality of object blocks other than said redundancy block; and

wherein if said data block to which the write data is to be written is said original object block, said first computer executable program instructions writes said write data to each of said original object blocks and to said copied block, and if said data block to which the write data is to be written is not said original object block, said first computer executable program instructions writes said write data to said data block to which the write data is to be written.

16. (New) A controller for a data storage system, said controller comprising a first interface for coupling to an information processor and a second interface for coupling to a plurality of data storage devices, said controller being responsive to read and write requests received through said first interface for reading data from, and for writing data to, respectively, said plurality of data storage devices through said second interface, said controller further comprising a request

receiver and a reply transmitter for coupling to said information processor through said first interface, said controller further comprising a redundancy block generator, a block rebuilder, a data storage device defect detector, a block writer, a block reader and a rebuild block overwriter all of which are coupled to said plurality of data storage devices through said second interface and that cooperate to store block groups in a dispersed fashion in plural ones of said data storage devices, where each of said block groups is comprised of object blocks comprised of plural data blocks and at least one redundancy block for use by said block rebuilder for error recovery purposes in response to said defect detector detecting a defect, where said block writer operates to store, in different ones of said storage devices, each of the object blocks as a plurality of uncopied blocks and as a copied block that is a copy of one of said object blocks; where said block rebuilder operates, in response to said defect detector detecting a defect in a storage device that stores one of said uncopied blocks, to rebuild the corresponding defective block as a rebuilt block; and said rebuild block overwriter operates to overwrite the rebuilt block into the copied block unless the copied block corresponds to the defective block.

17. (New) A controller as in claim 16, where said copied block is a copy of one of said data blocks.

18. (New) A controller as in claim 16, where said copied block is a copy of said redundancy block.

19. (New) In a data storage system comprised of N storage devices, a method comprising:

storing data in stripes across the N storage devices by storing in an interleaved manner N-2 data blocks, one redundancy block for error recovery purposes, and one copied block; and

upon detecting a defective storage device, rebuilding (N-2)/N of the stripes such that, for a given one of the stripes, the stripe is rebuilt if the block that is stored on the defective storage device is other than a copied block or an original block from which the copied block was made.

20. (New) A method as in claim 19, where said copied block in each stripe is a copy of one of said data blocks.

21. (New) A method as in claim 19, where said copied block in each stripe is a copy of said redundancy block.

22. (New) A storage controller for use in a RAID data storage system comprised of N storage devices, said storage controller operating under the control of a program comprised of computer instructions that direct said storage controller to store data in stripes across the N storage devices by storing in an interleaved manner N-2 data blocks, one redundancy block for error recovery purposes, and one copied block, said computer instructions further directing said storage controller, upon detecting an occurrence of a defective storage device, to rebuild (N-2)/N of the stripes such that, for a given one of the stripes, the stripe is rebuilt if the block that is stored on the defective storage device is other than a copied block or an original block from which the copied block was made.

23. (New) A storage controller as in claim 22, where said copied block in each stripe is a copy of one of said data blocks.

24. (New) A storage controller as in claim 22, where said copied block in each stripe is a copy of said redundancy block.

25. (New) A plurality N of data storage devices coupled to a storage controller in a data storage system, said N data storage devices having data stored in stripes across the N data storage devices in an interleaved manner, each stripe comprising N-2 data blocks, one redundancy block for error recovery purposes, and one copied block, and upon an occurrence of a defect in one of said N data storage devices, the N data storage devices storing rebuilt data in (N-2)/N of the stripes such that, for a given one of the stripes, the stripe stores rebuilt data if the block that is stored on the defective one of the N data storage devices is other than a copied block or an original block from which the copied block was made.

26. (New) A plurality N of data storage devices as in claim 25, where said copied block in each stripe is a copy of one of said data blocks.

27. (New) A plurality N of data storage devices as in claim 25, where said copied block in each

stripe is a copy of said redundancy block.

28. (New) A storage controller for use in a data storage system comprised of N storage devices, said storage controller comprising a first interface for coupling to an information processor and a second interface for coupling to the N storage devices, said storage controller further comprising data storage means for storing data in stripes across the N storage devices by storing in an interleaved manner N-2 data blocks, one redundancy block for error recovery purposes, and one copied block, said storage controller further comprising rebuilder means, responsive to detecting an occurrence of a defective one of said N storage devices, for rebuilding (N-2)/N of the stripes such that, for a given one of the stripes, the stripe is rebuilt if the block that is stored on the defective storage device is other than a copied block or an original block from which the copied block was made.

29. (New) A storage controller as in claim 28, where said copied block in each stripe is a copy of one of said data blocks.

30. (New) A storage controller as in claim 28, where said copied block in each stripe is a copy of said redundancy block.